FIELD SAMPLING PLAN

PART A OF THE SAMPLING AND ANALYSIS PLAN
APPENDIX A OF THE REMEDIAL ACTION MANAGEMENT PLAN

LANDFILL REMOVAL
FORMER NPD LABORATORY
TROUTDALE, OREGON

Prepared for:

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July 18, 2003

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Contract No. DACA67-00-D-1009
Delivery Order 0014

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ABBREVIATIONS AND ACRONYMS

ASTM	American Society for Testing and Materials
Bgs	below ground surface
Cherokee	Cherokee General Corporation
CLP	Contract Laboratory Program
COR	Contracting Officer's Representative
DFSI	Draft Final Site Investigation Report
DQO	data quality objective
DRO	total petroleum hydrocarbons as diesel-range-organics
EPA	U.S. Environmental Protection Agency
Farallon	Farallon Consulting, L.L.C.
FSP	field sampling plan
ML	milliliter
MS/MSDs	matrix spike/matrix duplicates
ORO	total petroleum hydrocarbons as oil-range-organics
PCBs	polychlorinated biphenyls
PID	photoionization detector
PM	project manager
Ppb	parts per billion
PPE	personal protective equipment
ppm	part per million
PRGs	preliminary remediation goals
QA	Quality Assurance
QA/QC	quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RAMP	Remedial Action Management Plan
RI	
RPD	relative percent difference
SAP	Sampling and Analysis Plan

SDGs	sample delivery groups
STL	Severn Trent Laboratories, Inc.
SI	site investigation
SSHO	Site Safety and Health Officer
SSHP	Safety and Health Plan
SVOCs	semivolatile organic compounds
TPH	total petroleum hydrocarbons
URS	URS Corporation
USACE	U.S. Army Corps of Engineers
UST	underground storage tank
VOCs	volatile organic compounds

1.0 INTRODUCTION

The Sampling and Analysis Plan (SAP) is an integral part of the Remedial Action Management Plan (RAMP) for the landfill removal action at the former North Pacific Division (NPD) laboratory site (the Site), located at 1491 NW Graham Road in Troutdale, Oregon. The purpose of the SAP is to ensure production of high quality data that meet project objectives and requirements, and to accurately characterize measurement parameters. The SAP provides the protocol for collecting samples, measuring and controlling data, and documenting field and laboratory data so that the data are technically and legally defensible.

The SAP has two major components: Part A – this Field Sampling Plan (FSP) and Part B – the Quality Assurance Project Plan (QAPP). The FSP presents the detailed scope of work associated with field activities (e.g., sample types and sampling locations) and specifies the procedures to be used for sampling and other field operations. The QAPP describes the analytical data quality objectives (DQO), laboratory analytical procedures, quality assurance/quality control (QA/QC) procedures, and data quality evaluation criteria.

Both the FSP and the QAPP have been prepared as follow-on documents to the FSP and the QAPP that were prepared for the Site Investigation (SI) at the NPD laboratory conducted in 2001/2002 by URS Corporation (URS) for the Seattle District of the U.S. Army Corps of Engineers. This was done to ensure sample data comparability. Where appropriate, reference is made to corresponding information in the management planning documents prepared for that effort.

1.1 PROJECT BACKGROUND

Cherokee General Corporation (Cherokee), under contract to the Seattle District of the U.S. Army Corps of Engineers (USACE), (Contract Number DACA67-00-D-1009, Delivery Order 0014), will perform the removal and disposal of the landfill materials at the Site in Troutdale, Oregon. A total of approximately 12,000 tons of landfill contents will be removed from the Site and transported to a permitted landfill for disposal.

1.1.1 Site History and Contaminants

The NPD laboratory operated at 1491 NW Graham Road as a materials testing facility from 1949 until 1997. Hazardous and toxic samples were analyzed by the laboratory from 1986 until the cessation of operations at the Site in 1997. The laboratory used the northern portion of the property as a landfill for disposal of residual bulk materials that the laboratory had tested, such as gravel aggregate and concrete. The landfill also was used to dispose of solid waste material such as steel drums of hardened concrete, asphaltic paper, and fiberglass insulation. The landfill was unlined, and all material was placed directly over native soil. Structural concrete test pours were conducted southeast of the landfill in 1952, and southwest of the landfill in the early 1980s. Landfill activities at the Site ceased in 1994.

The results of the SI were presented in the *Draft Final Site Investigation Report* (DFSI) prepared by URS dated August 30, 2002 (URS 2002). This report identified benzo(a)pyrene and arsenic as exceeding the U.S. Environmental Protection Agency (EPA) 2000 Region 9 Preliminary Remediation Goal (PRG) screening values in soil samples collected from the landfill (RAMP, Table 5.1). These contaminants represent a potential human health risk and have been identified as COPCs for this removal action. The DFSI recommendations included removal of the landfill contents using industrial soil PRGs as guidance values for cleanup.

The 2000 Region 9 PRGs were updated subsequent to the publication of the SI. The updated values were published in October 2002. This removal action will be performed using the 2002 PRGs as cleanup action goals. All references to PRGs in the text are in reference to the 2002 PRGs. Both the 2000 PRGs used to develop the SI and the 2002 PRGs applied to this project are presented in the tables.

2.0 FIELD ACTIVITIES

Field activities will be conducted to characterize the contents of the former NPD laboratory landfill, excavate and remove the landfill contents, and confirm that the removal was successfully performed. Each activity described in this section will involve field sampling. This document will enable or support collection of representative data during sampling activities.

As part of the field activities, the following definable features of work will take place:

- **WASTE CHARACTERIZATION:**
  - Site Survey and Grid Staking; and
  - In-Situ Waste Characterization.

- **SITE PREPARATION**:
  - Equipment and Facilities Mobilization;
  - Clearing and Grubbing;
  - Erosion Control and Security Fencing;
  - Site Access Road Construction;
  - Truck Decontamination Pad Construction; and
  - Roll-off Staging Area Construction.

- **WASTE EXCAVATION**:
  - Dust Control;
  - Waste Excavation and Loading;
  - Segregation of Waste Inconsistent with Profile;
  - Characterization of Waste Inconsistent with Profile;
  - Roll-off Pickup and Stockpile Removal;
  - Subgrade Excavation Stockpiling, and Characterization; and
  - Additional Incidental Excavation and Material Removal.

- **CONFIRMATION SAMPLING AND SITE CLEANUP**:
  - Confirmation Sampling;
  - Backfill Sampling;
  - Backfill, Grading, and Compaction;
  - Site Cleanup; and
  - Hydroseeding.

Each of these definable features of work is discussed in detail in the RAMP. Field sampling activities will be performed as a component of the following definable features:

- **WASTE CHARACTERIZATION:**

- In-situ waste characterization.

- **WASTE EXCAVATION:**
  - Characterization of waste inconsistent with profile; and
  - Characterization of waste accumulated in roll-off bins.

- **CONFIRMATION SAMPLING, BACKFILL PLACEMENT, AND SITE CLEANUP:**
  - Confirmation sampling; and
  - Backfill sampling.

The following sections describe sampling that will be performed to complete these activities.

2.1 WASTE CHARACTERIZATION

Before excavation is initiated, the landfill contents will be characterized in-situ for purposes of waste profiling. A total of 24 profile samples will be required to obtain approximately one profile sample for every 500 tons of the landfill material to be removed for disposal. This number of samples is designed to meet the requirements of Contract Specification Section 02060 and the request by the disposal landfill operator, Waste Management, Inc., that at least one profile sample be provided for every 500 tons of material disposed.

2.1.1 Sampling Locations

This section describes the locations of the soil samples that will be collected to characterize the contents of the landfill prior to any removal action. To accomplish the characterization, a grid will be established across the aerial extent of the landfill. The grid will be sized to produce a total of 24 grid squares within the footprint of the landfill. It is estimated that a 30-foot by 30-foot grid will be established. Grid nodes will be marked with stakes. Test pits will be excavated at the center of each grid. Where the landfill footprint covers a partial grid square, the test pit will be excavated from the approximate center of the landfill contents within the grid square (See Figure 1).

The grid will be tied to a benchmark such that it can be re-established after the landfill contents have been removed. Confirmation samples will be collected from undisturbed soil beneath the landfill at the same 24 grid locations that are used for waste characterization.

2.1.2 Test Pit Methodology and Procedures

Cherokee will use a Case 580 backhoe (or equivalent) to excavate each test pit. The test pits will be excavated from the existing landfill surface down to undisturbed native soil as determined by visual inspection. The pits will vary in depth from less than 3 feet to 12 feet. The soil removed from each test pit will be stockpiled adjacent to the pit. The test pits will be excavated to a size that allows for visual logging of subsurface conditions from the ground surface. The test pits will be logged by a geologist registered in the state of Oregon according to American Society for Testing and Materials D2488 (ASTM 2000). Soil samples will be collected either directly from the center of the backhoe bucket or from discrete depth intervals using a hand auger. In either case, sampling will be conducted to ensure that a sample representative of the vertical profile of the landfill is collected. No one will enter a test pit. Each test pit will be backfilled following sampling and logging.

2.1.3 Sample Collection and Analysis

Representative soil samples will be collected over the vertical profile from the sidewall of each test pit. The samples will be collected using a methodology that best characterizes the cross section of the landfill contents. Collection will involve using the backhoe to scrape material from the test pit sidewall from the bottom to the top of the pit. Depending upon the observed lithology and contents of the test pit, samples may also be collected by discretely scraping sidewall material from specified depth intervals for compositing to provide a representative sample. Alternatively, a hand auger system may be used to obtain representative sample aliquot from specified depth intervals for compositing. The remaining material from the backhoe bucket or auger bucket then will be homogenized manually by mixing in a stainless steel bowl, and the required sample containers will be filled, resulting in a sample that is representative of the pit cross section.

Samples from each test pit will be submitted to the analytical laboratory for analysis of semivolatile organic compounds (SVOCs), volatile organic compounds (VOCs), organochlorine pesticides/polychlorinated biphenyls (PCBs), total metals EPA Contract Laboratory Program (CLP) Target Analyte List plus strontium and uranium, total cyanide, and total petroleum hydrocarbons (TPH) as diesel-range-organics (DRO) and oil-range-organics (ORO). The soil samples will be analyzed by Severn Trent Laboratories (formerly Sound Analytical Services, Inc.) according to the methods presented in Table 2-1.

A different sample collection methodology will be used to obtain samples for VOC analysis in order to minimize volatilization during the collection process. Discrete samples will be collected from three levels within the pit; including one from the upper third, one from the middle third, and one from the bottom third of the pit cross section. An equal quantity of material from each of the samples will placed in a single container sample jar. The methanol preservative provided by the laboratory will be added to the jar and the jar sealed in accordance with the sample collection procedures for samples anticipated to contain VOCs in concentrations greater than 200 parts per billion (ppb). Any VOCs in the sample will be effectively composited by the methanol extraction solvent.

TCLP analysis will also be performed on any samples found to contain total constituent concentrations greater than 20 times the maximum concentration of contaminants for the toxicity characteristic as a hazardous waste as described in 40 CFR 261.20 Subpart C Characteristics of a Hazardous Waste.

Table 2-1
Soil Analytical Methods

Parameter	Method
Volatile Organic Compounds (at anticipated concentrations greater than 200 ppb)	EPA SW-846 Method 5035/8260B with methanol preservative.
Semivolatile Organic Compounds	EPA SW-846 Method 3550B/8270C
Organochlorine Pesticides and PCBs	EPA SW-846 Method 3550B/8081A/8082
Total Metals[a]	EPA SW-846 3051.6010B/6020/7471B
Total Cyanide	EPA SW-846 Method 9013/9012A
TCLP	EPA SW-846 Method 1311
TPH as DRO and ORO	NWTPH-Dx

[a]Metals include aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, strontium, thallium, uranium, vanadium, and zinc.

Data from the analysis of these samples will be used to determine the waste profile applicable to each grid square. It is anticipated that most, if not all, grid squares will be characterized as state-regulated, non-hazardous waste, suitable for direct landfill in a Subtitle D landfill. This expectation is based on the test pit data obtained from the test pits that were excavated within the landfill during the DFSI. All five pit samples were consistent with the aforementioned non-hazardous waste characterization.

2.2 WASTE EXCAVATION

After the waste characterization data have been received and reviewed, all grids consistent with the non-hazardous waste profile will be designated for excavation directly into trucks for removal, transport, and disposal. Grids that do not conform to the non-hazardous waste profile will be designated for segregation and special handling.

Based on the RI, it is anticipated that the landfill contents will be non-hazardous and suitable for direct disposal in a Subtitle D landfill. Further, it is anticipated that Level D or C PPE is appropriate for the management of the landfill contents. Should the in situ waste characterization determine these assumptions to be invalid, work will cease, and the USACE Contracting Officer's Representative will be notified.

In addition, should any condition be encountered as excavation progresses requiring an upgrade to Level B or A PPE to safely manage fieldwork, all work will cease, and the USACE Contracting Officer's Representative will be notified. Items or materials that would necessitate Level B or A PPE would include any sealed container potentially containing residual liquid, or sludge or soil that creates breathing zone organic vapor concentrations greater than 50 parts per million (ppm) as measured by a photoionization detector (PID).

The flow chart presented in Figure 3 of the RAMP schematically presents the waste removal management process, including the assessment and handling of those landfill contents that do not meet the non-hazardous waste profile requirements established during in situ characterization.

Following removal of the landfill contents, 6-inches of native material will be removed and stockpiled for characterization. The footprint of the landfill will then be sampled to confirm that COPC cleanup action levels for the project have been met. The cleanup action levels established for this project are the 2002 EPA Region 9 Soil PRGs for industrial property (RAMP, Table 5.1).

2.2.1 Waste Excavation for Direct Loading

Grids that are determined to be consistent with the non-hazardous waste profile will be excavated directly into trucks for removal from the Site and disposal. The excavation will be monitored by a hazardous waste technician to confirm that the material being directly loaded into trucks for disposal is consistent with the non-hazardous waste profile. The hazardous waste technician will monitor the waste visually and using a PID to monitor for the presence of VOCs. Any material that appears to be inconsistent with the non-hazardous waste profile will be segregated and moved into one of the five roll-off bins using a Case 580 (or equivalent) backhoe/loader. The types of material that may be encountered and require special handling would include stained or contaminant saturated soil, pockets of sludge, soils inhibiting noticeable odor, paint cans and sample jars, and drums with bungs containing unknown materials. All decisions regarding management of materials inconsistent with non-hazardous waste profile will be made by the USACE Project Manager.

Similar materials, such as petroleum-saturated soil and soil containing large quantities of paint cans, will be consolidated in single roll-offs. When a roll-off is loaded to capacity, it will be sampled to determine disposal requirements, as described below.

2.2.2 Non-conforming Grids

Grids that are found to exhibit characteristics inconsistent with the non-hazardous waste characterization during in-situ sampling will be excavated and stockpiled for further testing. During this excavation, any material within the grid that appears inconsistent with a non-hazardous waste characterization (such as petroleum-saturated soil or soil containing large quantities of paint cans) will be further segregated and placed in a roll-off bin.

Soil stockpiled from non-conforming grids will be further characterized for waste classification and determination of appropriate disposal requirements. The stockpiles accumulated from each non-conforming grid are anticipated to vary from 100 to 500 cubic yards in size. Samples of equal quantity will be collected from a minimum of five locations in each stockpile and will be homogenized. A sub-sample of the homogenized material will be placed in the required number of sample containers for submittal to the analytical laboratory.

The sample will be submitted to the analytical laboratory for analysis of SVOCs, VOCs, organochlorine pesticides/PCBs, total metals, strontium and uranium, total cyanide, and TPH as DRO and ORO, and TCLP if determined necessary. The soil samples will be analyzed by Severn Trent Laboratories according to the methods presented in Table 2-1.

A different sample collection methodology will be used to obtain samples for VOC analysis in order to minimize volatilization during the collection process. Discrete samples will be collected from a minimum of five locations in the stockpile. An equal quantity of material from each of these locations will be used to fill a sample container. The methanol preservative provided by the laboratory will be added to the container and the container will be sealed. Any VOCs in the sample will be effectively composited by the methanol extraction solvent.

These data will be used to characterize and profile the stockpiled material for removal and disposal.

2.2.3 Roll-Off Bin Sampling

Materials removed from the landfill and those segregated that are not suitable for placement in stockpiles (e.g. paint cans, sludges, saturated soil) will be placed in roll-off bins. As roll-off bins are filled, or when landfill excavation operations have been completed, the roll-off bins will be sampled, characterized, and profiled for disposal. Each 20 cubic yard bin will be sampled using a methodology similar to that implemented for stockpile characterization. Samples of equal quantity will be collected from a minimum of three locations in each bin and will be homogenized. A representative sample of the homogenized material will be placed in a sample container.

The sample will be submitted to the analytical laboratory for analysis of SVOCs, VOCs, organochlorine pesticides/PCBs, total metals, strontium and uranium, total cyanide, and TPH as DRO and ORO, and TCLP if determined necessary. The soil samples will be analyzed by Severn Trent Laboratories according to the methods presented in Table 2-1.

A different sample collection methodology will be used to obtain samples for VOC analysis in order to minimize volatilization during the collection process. Discrete samples will be collected from a minimum of three locations in each bin. An equal quantity of material from each of these locations will be placed in a single sample container. The methanol preservative provided by the laboratory will then be added to the sample. Any VOCs in the sample will be effectively composited by the methanol extraction solvent.

These data will be used to characterize and profile the roll-off material for removal and disposal.

2.2.4 Incidental Excavation and Material Removal

Additional waste characterization samples will be taken from areas where incidental material removal takes place and existing analytical data are insufficient to characterize and profile the waste for disposal. Discrete soil characterization samples will be taken at a frequency of approximately one per 500 tons of material to be removed for disposal. Samples will be submitted to the analytical laboratory for analysis of SVOCs, VOCs, organochlorine pesticides/PCBs, total metals, strontium and uranium, total cyanide, and TPH as DRO and ORO, and TCLP if determined necessary. The soil samples will be analyzed by Severn Trent Laboratories according to the methods presented in Table 2-1.

2.3 CONFIRMATION SAMPLING, BACKFILL PLACEMENT, AND SITE CLEANUP

Following completion of the landfill removal action, up to 6 inches of underlying native soil will be excavated and stockpiled. The stockpiled material will be sampled to determine its suitability as backfill using the sampling procedures described in Section 2.3.2. The area exposed by the landfill removal action then will be surveyed to re-establish the grid that was used during landfill characterization. A sample of surface soil will then be collected from the center of each grid. The results of these sample analyses will be compared to the COPC cleanup action levels established for the project to determine if additional soil will require removal and disposal. If it is determined by the USACE that COPC concentrations exceed project cleanup criteria, additional material will be removed from the gridat the direction of the USACE Contracting Officer's Representative (COR).

An off-Site source of backfill material will be identified to bring the Site to final lines and grades. Prior to bringing any off-Site material onto the Site, the backfill material will be sampled and analyzed to ensure that the material does not contain contaminants at concentrations greater than the cleanup action criteria (RAMP, Table 5.1).

The following paragraphs describe the field sampling associated with these activities.

2.3.1 Confirmation Sampling

The original sample grid will be re-established by a licensed surveyor. Surface soil samples, collected from the surface to a depth of 6 inches, will be taken from the center of each grid square. The samples will be submitted to the analytical laboratory for analysis of SVOCs and total arsenic The soil samples will be analyzed by Severn Trent Laboratories according to the methods presented in Table 2-1.

In areas where incidental material removal has taken place, as described in Section 5.4.7 of the RAMP, confirmation samples will be collected and analyzed for COPCs as described in this section. Where incidental material removal has taken place one confirmation sample will be collected per 500 square feet of area exposed by the excavation.

2.3.2 Native Soil Stockpile Sampling

Soil stockpiled from the removal of the 6 inches of native soil from the landfill footprint will be sampled to determine if it is suitable to use as backfill. It is estimated that this stockpile will contain approximately 100 to 200 cubic yards of soil. Samples of equal quantity will be collected from five locations in each stockpile and will be homogenized. A sub-sample of the homogenized material will be placed in the requisite number of sample containers and submitted to the analytical laboratory.

This sample will be submitted to the analytical laboratory for analysis of SVOCs, organochlorine pesticides/PCBs, total metals, strontium and uranium, total cyanide, and TPH as DRO and ORO. The soil samples will be analyzed by Severn Trent Laboratories according to the methods presented in Table 2-1.

A different methodology will be used to obtain a sample for VOC analysis in order to minimize volatilization during the collection process. Discrete samples will be collected from five locations in the stockpile. An equal quantity of material from each of these locations will be placed in a sample container. VOC samples will be collected using the EPA SW-846 Method 5035 preservative protocol for soil samples anticipated to contain VOCs at levels less than 200 ppb. Any VOCs in the sample will be effectively composited by the addition of the sample preservative.

These data will be used to determine if the stockpiled soil can be used for backfill. Stockpiled soil will be determined suitable as backfill if analysis indicates all constituents analyzed are less than project cleanup criteria (2002 Region 9 PRGs). If the soil that is analyzed is determined to meet the PRGs, it will be spread back onto the landfill site and compacted. If the soil is found unsuitable as backfill, it will be removed for disposal. The backfill material stockpile analytical data will be used to determine the waste classification.

2.3.3 In-haul Backfill Material Sampling

Additional backfill material will be brought on-Site, placed, and compacted to provide an even grade that is consistent with existing Site drainage. Sufficient material will be placed and graded such that no slope will exceed approximately 2 percent.

Before the proposed backfill is brought on Site, a representative sample will be analyzed to determine its suitability for use. One representative soil sample will be taken from the borrow pit that has been proposed as the backfill supplier. This sample will be submitted to the analytical laboratory for analysis of VOCs, SVOCs, organochlorine pesticides/PCBs, total metals, strontium and uranium, total cyanide, and TPH as DRO and ORO. The VOC sample will be collected using the EPA SW 846 Method 5035 preservative protocol for soil samples anticipated to contain VOCs at levels less than 200 ppb. The in-haul backfill material sampling will be conducted using the procedures described previously for the Native Soil Stockpile sampling. The soil samples will be analyzed by Severn Trent Laboratories according to the methods presented in Table 2-1.

2.4 FIELD QUALITY CONTROL SAMPLES

Field quality control (QC) samples will be used to evaluate data quality. QC samples are controlled samples introduced into the analysis process whose results are used to review data quality, and to calculate the accuracy and precision of the chemical analysis program. The purpose of each type of field QC sample, collection and analysis frequency, evaluation criteria, and methods of collection are summarized in this section and are described in more detail in the accompanying QAPP.

Field QC checks are accomplished through the analysis of controlled and select samples that are introduced to the laboratory from the field. Rinsate blanks, trip blanks, and field duplicates will be collected and submitted to the laboratory to provide a means of assessing the quality of data resulting from the field sampling program. The laboratory will prepare matrix spike/matrix duplicates (MS/MSDs) to assess sample matrix interferences and analytical errors, as well as to measure the accuracy and precision of the analysis.

2.4.1 Rinsate Blanks

Rinsate blanks are collected to determine the potential for cross-contamination of samples during collection, through an assessment of the decontamination process. Rinsate blanks will be collected and analyzed at the rate of 5 percent of the samples submitted if non-dedicated sampling equipment is used. Rinsate blanks will consist of laboratory-supplied, deionized water collected following the final rinse of sampling equipment after the decontamination procedures are complete.

The rinsate soil blank will be collected from the stainless steel bowls that will be used to collect and composite soil samples prior to placing them in sample containers. The rinsate blank will be collected by filling the bowl with approximately 2 gallons of laboratory-supplied, deionized water and then filling pre-labeled, laboratory-supplied sample containers.

All rinsate blanks will be submitted blind to the laboratory, with sample numbers that do not indicate they are quality control samples. QC criteria and corrective actions are the same as for method blanks (as described in the QAPP). Blank samples will be analyzed for the same parameters as the associated field samples.

2.4.2 Trip Blanks

Trip blanks are analyzed only for VOCs, and are used to determine if contamination has occurred during sampling, handling, shipping, or storage of samples or sample bottles. One trip blank (one 4-ounce glass jar or 40-mL vial containing methanol) for each cooler containing soil samples will be submitted to the project laboratory for VOC analysis.

Trip blanks will be provided by the laboratory. After they have been prepared, the trip blank sample containers are not to be opened until their return to the laboratory. Each trip blank will be inspected for overall condition, which will be noted in the field logbook. Each trip blank will be assigned a number, which will be recorded in the field logbook and on the chain-of-custody form. Trip blanks will be analyzed at a rate of one per cooler containing samples for VOC analysis. QC criteria for trip blanks require that no contaminants be detected in the blanks.

2.4.3 Field Duplicates

Field duplicate samples will be used to check for sampling reproducibility. Field duplicates will be collected from sampling locations with potentially high concentrations of target analytes. Field duplicates will be submitted to the laboratory at a frequency of 10 percent of the field samples for every analytical method. Field duplicate samples will be collected in conjunction with, and analyzed by, the same methods as the primary sample. Control limits for field duplicate precision are 50 percent relative percent difference (RPD) for those soil samples that report the presence of contaminants at concentrations greater than five times the laboratory reporting limit.

Field duplicates will be submitted blind to the laboratories, with sample numbers that are indistinguishable from primary samples. QC criteria for field duplicates, and calculation and reporting of the RPD are described in the QAPP.

2.4.4 Matrix Spike/Matrix Spike Duplicates

MS/MSDs are used to assess sample matrix interferences and analytical errors, as well as to measure the accuracy and precision of the analysis. The MS/MSDs will be collected and analyzed at a rate of 5 percent of the field samples for each analytical method, or at least one for each analytical batch, whichever frequency is greater. After known concentrations of analytes are added to environmental samples; the MS or MSD is processed through the entire analytical procedure, and the recovery of the analytes is calculated. Results are expressed as percent recovery of the known spiked amount (and RPD for MS/MSD pairs).

Field duplicate and MS/MSD samples will be collected from different locations. Additionally, MS/MSD samples should not be collected from locations with potentially high concentrations of target analytes that may mask the added MS/MSD compounds.

2.4.5 Temperature Blanks

One temperature blank will be prepared and submitted to the laboratory with each cooler. The temperature blank will consist of a sample jar containing water, which will be packed on ice in the cooler in the same manner as the rest of the samples. The temperature blank is to be used to measure the temperature of the cooler when the cooler arrives at the laboratory.

2.5 DECONTAMINATION OF SAMPLING EQUIPMENT

Equipment used during the waste characterization and sampling activities will be decontaminated before use at the Site and between sampling locations to prevent cross-contamination. The field activities in which decontamination procedures will be followed include sampling soil, completing test pits, and all associated sampling activities. The specific procedures for decontamination are outlined in this section.

Sampling equipment includes all sampling devices used to collect or contain a sample prior to its placement into a laboratory-provided sample container. Such equipment may include stainless steel spoons and bowls, hand augers, push samplers, and the backhoe bucket. Before initial use, all sampling equipment that may contribute to the contamination of a sample must be thoroughly decontaminated, unless specific documentation exists to show that the sampling equipment has been decontaminated previously. Pre-cleaned equipment in factory-sealed containers does not require decontamination.

The sampling equipment will be decontaminated between sample locations according to the following instructions:

1. Thoroughly scrub equipment using phosphate-free detergent and potable water. Use a brush to remove any particulate matter or surface film.
2. Thoroughly rinse the outside, and flush the inside, of equipment with clean potable water.
3. Rinse and flush equipment with clean, laboratory-supplied water that is free of analytes of concern.
4. Rinse equipment with reagent-grade cyclohexane or hexane.
5. Allow equipment to air-dry; then wrap it in foil if it is not to be used immediately.

Excavating equipment will be decontaminated within the fenced landfill area, and wash water will be allowed to infiltrate the ground surface. The backhoe bucket will be hot-water pressure washed between test pit excavations.

2.6 CALIBRATION OF FIELD INSTRUMENTS

All calibration procedures and measurements will be conducted in accordance with the manufacturer’s specifications. Field instruments will be checked and calibrated before their use on Site; batteries will be charged and checked daily. A three-point initial calibration will be conducted on the instrument being used, if applicable. One-point calibrations may be used thereafter.

Instrument calibration will be conducted at the beginning of each workday, and through the course of the day, if necessary. A final calibration will be conducted at the end of the day after the last field sample has been analyzed. Special attention will be given to instruments that may drift with any change in ambient temperature or humidity. Equipment that fails calibration and/or becomes otherwise inoperable during the field investigation will be removed from service and will be segregated to prevent inadvertent use. Such equipment will be tagged to indicate that it should not be used until it has been repaired. Equipment that cannot be repaired or recalibrated will be replaced.

All documentation pertinent to the calibration and/or maintenance of field equipment will be maintained in an active field logbook.

3.0 SAMPLE HANDLING AND DOCUMENTATION

This section describes sample handling and documentation procedures. The procedures described are designed to provide a thorough record of events surrounding the collection of each sample, and to ensure, as far as can be accomplished in the field, that the data collected are useable.

3.1 FIELD LOGBOOKS

Permanently bound field books with waterproof paper will be used as field logbooks because of their compact size, durability, and secure page binding. The pages of the logbook should be numbered consecutively and should not be removed for any reason. Entries will be made in black, waterproof indelible ink.

Logbooks will document the procedures performed by field personnel. Each entry will be dated, legible, and will contain accurate and complete documentation of individual activities. Documentation in the field logbook will be at a level of detail sufficient to explain and reconstruct field activities without relying on recollection by the field team members. Because the logbook is a complete documentation of field procedures, it should contain only facts and observations. Language should be objective, clear, concise, and free of personal interpretation or terminology that might be misconstrued.

No erasures will be allowed. If an incorrect entry is made, the information will be crossed out with a single strike mark, and the change will be initialed and dated by the team member making the change.

Field logbooks will be identified by the project name and project-specific number (e.g., Logbook #1 for Former North Pacific Division Laboratory Landfill Removal Action), and will be stored in the field project files when not in use. Field logbooks will be photocopied after the field investigation, and photocopies will be stored in the permanent project files. After field activities have been completed, logbooks will be stored in the permanent project file.

3.2 SAMPLE IDENTIFICATION AND LABELING

To provide a sample tracking mechanism, each sample collected will be given a sample identification number. The sample identification number will include a prefix describing the sample type, the grid number, and an identification of the type of sample (e.g., primary, field duplicate). The following sample type abbreviations will be used:

TP = Test Pit

SP = Stockpile

RO = Roll-off

SS = Surface Soil

The Site name and sampling date will not be included in the sample identification number because this information will be recorded on the sample label and chain-of-custody form. The sample type, station number, and depth designations are shown below.

MS/MSD samples will not be designated in the primary sample number. The sample to be used for MS/MSD analysis will be specified in the comment section of the chain-of-custody. Trip blanks will be numbered with the prefix TB, followed by a sequential number beginning with 001. The QC field duplicate and field or rinsate blank samples will be identified with a fictitious station number of the primary sample. The fictitious station numbers used to identify QC field duplicates and field or rinsate blanks will consist of a constant integer added to the number of the primary sample location that has been chosen as the QA station. A field duplicate sample will be designated by adding the integer 300 to the station number from which it was collected. A rinsate blank sample will be designated by adding the integer 600 to the station number from which the blank was collected. No indication that a sample is a duplicate will be provided on the sample label or chain-of-custody form. Cross-references for duplicate and blank sample numbers will be clearly recorded in the field book and field logs.

- Example 1: A primary soil sample collected from a depth of 5 feet below ground surface at TP-1 would be labeled TP-001-05. A waste profile sample collected from the surface of the landfill to a depth of 12 feet at TP-1 would be labeled TP-001-0-12. A corresponding VOC sample taken from the same location would be labeled TP-001-0-12V.
- Example 2: A duplicate of primary sample TP-001-05 would be labeled TP-301-05.
- Example 3: A rinsate blank of primary sample TP-001-05 would be labeled TP-601-05.
- Example 4: The fourth trip blank submitted for this investigation would be designated TB-004.

Sample labels, whether blank or pre-printed, will contain an abbreviated summary of the logbook entry for the sample. The following information will be included on sample container labels:

- Project number and name;
- Site location;
- Sample identification number;

- Date and time of sampling;
- Initials of sampling personnel; and
- Type of sample preservatives added.

3.3 SAMPLE DELIVERY GROUP

Soil and groundwater samples will be sent to the analytical laboratories in sample delivery groups (SDGs). Each SDG will consist of primary samples, blind field duplicates, associated MS/MSD samples, and/or rinsate and trip blanks.

3.4 SAMPLE PRESERVATION AND HANDLING

This section describes the techniques used to handle and preserve samples once they have been collected, including descriptions of sample containers, preservation techniques, and storage requirements.

3.4.1 Sample Containers

Soil samples (primary as well as QC) will be collected in glass containers supplied by the analytical laboratory. The containers will have screw-type lids to ensure that the bottles are adequately sealed. Teflon® inserts inside the lids of the containers will prevent sample reaction with the lid, and will improve the quality of the seal. The specific container types, volumes, number of containers, and holding times for each analysis for soil are listed in Table 3-1.

Containers will be pre-cleaned and certified under chain-of-custody. Commercially available pre-cleaned containers are acceptable. The field team will record batch numbers for the bottles in the logbook. With this documentation, bottles can be traced, and bottle wash analyses can be reviewed.

3.4.2 Sample Preservation

Required preservatives for rinsate blanks will be added to the sample containers by the laboratory. The laboratory will affix waterproof labels to the bottles, on which the type and amount of preservative will be written.

Sample preservation procedures will be used to maintain the original character of analytes during storage and shipment. Regardless of the nature of the sample, absolute stability for all constituents cannot be achieved. Preservation techniques, such as pH control and refrigeration, may retard physicochemical and biochemical changes. As a general rule, analyzing the sample as soon as possible is the best way to minimize physicochemical and biochemical changes.

All samples will be placed in the appropriate sample container and refrigerated (on ice or ice-substitute in a cooler) immediately upon sample collection. Samples will be shipped to the laboratory on a daily basis. The analytical laboratory will meet all specified holding times and should make every effort to prepare and analyze the samples immediately after they are received. Chemical preservation, sample container types, and temperature requirements for the analyses performed in this investigation are shown in Tables 3-1.

3.4.3 Storage Requirements

Samples will be placed in secure, on-Site storage, or remain in the possession of sampling personnel until they are shipped or delivered to the laboratory. Immediately after collection, and during shipment to the analytical laboratory, samples will be stored on ice or an ice- substitute in coolers at approximately 4^{o}C. The ice or ice-substitute will be replenished as needed to ensure adequate cooling of samples during storage and shipping.

Table 3-1
Container, Preservation, and Holding Time Requirements for Soil

SOIL

Parameter	Method	Container	Number	Preservation Requirements	Holding Time
Volatile Organic Compounds	EPA SW-846 Method 5035/8260B	4 oz. with Teflon®-lined lid	1	4°C, methanol	14 days
Semivolatile Organic Compounds	EPA SW-846 Method 3550B/8270C	4 oz. glass	1	4°C	14 days to extract; 40 days analysis
Organochlorine pesticides and PCBs	EPA SW-846 Method 3550B/8081A/8082	4 oz. glass	1	4°C	14 days to extract; 40 days analysis
Total Metals	EPA SW-846 3051/6010B/6020/7471A	4 oz. glass	1	4°C	6 months (28 days for mercury)
Total cyanide	EPA SW-846 Method 9013/9012A	4 oz. glass	1	4°C	14 days
TPH as Diesel and Oil Range Organics	NWTPH-Dx	4 oz. glass	1	4°C	14 days to extract; 40 days analysis

WATER (rinsate blanks)

Parameter	Method	Container	Number Required	Preservation Requirements	Holding Time
VOCs	EPA SW-846 Method 5030B/8260B	40 ml VOA vial[a]	3	4°C, HCI to pH < 2	14 days
SVOCs	EPA SW-846 Method 3510C/8270C	1 L glass amber[a]	2	4°C	7 days extract/40 days analysis
Organochl	EPA SW-846 Method	1 L glass	2	4°C	7 days

Paramete r	Method	Contai ner	Nu mb er Req uire d	Preserva tion Require ments	Holding Time
orine Pesticides and PCBs	3510C/8081A/ 8082	amber[a]			extract/4 0 days analysis
Total Metals	EPA SW-846 3010A/6010B/6020 / 7470A	500 mL HDPE	1	4°C, HNO_3 to pH < 2	6 months (28 days for mercury)
Dissolved Metals (field filtered)	EPA SW-846 3010A/6010B/6020 / 7470A	500 mL HDPE	1	4°C, HNO_3 to pH < 2	6 months (28 days for mercury)
Total Cyanide	EPA SW-846 9012A	1 L HDPE	1	4°C, NAOH to pH > 12	14 days

[a]All glass sample containers will have Teflon®-lined lids.
[b]Sample will be filtered using a 0.45 µm filter prior to preservation.
Note:
HDPE - high density polyethylene

3.5 SAMPLE DOCUMENTATION

Entries into the logbook or other relevant sampling forms for sampling events will include, but not necessarily be limited to, the following:

- Project name, location, and number;
- Rationale for collecting the sample;
- Date and time of sampling;
- Sample numbers;
- Cross-reference of numbers for duplicate and blank samples;
- Media sampled;
- Geographical location of the sampling point in reference to Site facilities;
- Physical location of the sampling point, such as depth below surface;
- Method of sampling, including procedures, equipment, and any departure from the procedures specified in the RAMP;
- Rationale for any deviations from specified procedures and documentation;
- Results of field measurements;
- Sample preservation;
- Type and quantity of container used for each sample;
- Weather conditions at the time of sampling, and previous events that may influence the representative nature of a sample (at a minimum, temperature, approximate wind speed and direction, and sky cover will be included);
- Photographic information (a brief description of what was photographed and why, the date and time, the compass direction of the picture, the number of the frame on the roll, and the roll number);
- Sketches, when appropriate, with reference points tied to existing structures in the area (e.g., trees, existing monitoring wells);
- Analyses requested;
- Disposition of the sample (i.e., where it is being shipped);
- Airbill number of sample shipment, when applicable;
- Other pertinent observations, such as the presence of other persons on the Site; (those associated with the job, members of the press, special interest groups, or passersby), and actions by others that may affect performance of Site tasks;

- Type of health and safety clothing or equipment used; and
- Name(s) of sampling personnel.

3.6 CHAIN- OF-CUSTODY PROCEDURES

Verifiable sample custody is an integral part of all field and laboratory operations associated with this field investigation. The primary purpose of the chain-of-custody procedures is to document the possession of the samples from collection, through storage and analysis, to reporting. Chain-of-custody forms will become the permanent records of sample handling and shipment. The Field Superintendent or designee will be responsible for monitoring compliance with chain-of-custody procedures.

Field sampling personnel are responsible for the care and security of samples from the time the samples are collected until they have been turned over to the shipping agent or laboratory. A sample is considered to be in one's custody if it is in plain view at all times, in the physical possession of the sampler, or stored in a locked place where tampering is prevented.

Empty coolers containing ice or an ice-substitute will be available on Site for use each day in the field. Samples collected during the day will be stored in these coolers, beginning at the time of collection. The coolers will be locked inside the field vehicle or another secure location when sampling personnel are not present.

A chain-of-custody form will be filled out for the samples in each cooler, beginning when the first sample of each batch is collected. An example of the chain-of-custody record is shown in Attachment A. Each chain-of-custody form will contain the following information:

- Sample identification number;
- Date and time of sampling;
- Type of sample, and number of sample containers associated with each sampling point;
- Total number of sample containers in the cooler;
- Unique cooler identification number;
- List of analyses requested;
- Name and signature of sampling personnel;
- Shipping air bill number, when applicable;
- Comments regarding MS/MSD samples, or any other information that is necessary for the laboratory; and
- Spaces for transfer of custody acknowledgment.

When the chain-of-custody forms have been completed, field team members will cross-check the form for possible errors. If samples are repackaged for shipping or delivery, one team member will cross-check the chain-of-custody with the samples that are packed, while another team member packages the samples. Corrections will be made to each record with a single strike mark that is dated and initialed. The person who initials corrections will be the same person who relinquishes custody of the samples. The chain-of-custody forms will be signed and dated, placed in resealable plastic bags, and taped to the inside lid of the respective cooler.

3.6.1 Transfer to Project Laboratories

After a cooler of samples has been packaged and the chain-of-custody form has been completed, sampling personnel will close the cooler, seal it with packing tape, and affix two signed and dated custody seals so that if the cooler is opened, the seals will be broken. Custody seals will contain the following information:

- The sample team member's signature (the signature must match the signature on chain-of-custody forms), and
- The date.

Coolers with completed chain-of-custody documentation will be hand-delivered, sent by courier, or shipped by overnight courier to the laboratory by the sampling team. The shipping agent will not enter into the formal chain-of-custody procedures, and therefore will not sign the chain-of-custody form. Copies of bills of lading provided by the shipping agent will be kept with chain-of-custody forms in order to document shipping procedures.

3.6.2 Laboratory Custody Procedures

A cooler receipt form will be filled out by the laboratory (Attachment A). Upon the cooler's arrival at the laboratory, custody seals will be inspected, and the chain-of-custody forms will be signed and dated by laboratory personnel. Laboratory personnel will also verify sample numbers and the condition of each cooler. The laboratory will fax each chain-of-custody and cooler receipt form to the Cherokee Project Manager (PM) within 8 hours of receipt. Cherokee will be notified immediately of any discrepancies. Shipping manifests and chain-of-custody forms signed and dated by laboratory personnel will be considered sufficient documentation of sample custody transfer from the sampler, through the shipping agent, to the analyst in the contracted analytical laboratory.

A copy (pink) of each chain-of-custody form will be retained by the sampling team for the project file, and the original (yellow and white) will be sent with the samples. Bills of lading will be retained as part of the documentation for the chain-of-custody records. In conjunction with data reporting, the analytical laboratory will return the original chain-of-custody forms to the project manager for inclusion in the central project file.

3.7 DAILY CHEMICAL QUALITY CONTROL REPORTS

Field activities will be documented using the daily chemical quality control report (DCQCR) form. An example DCQCR form is included in Attachment A. The reports will be prepared and submitted daily, and will summarize field and laboratory activities and results. All field measurement data and field sampling decisions will be made available to the USACE within 24 hours of sample collection. The DCQCR will contain the following details:

- Project information;
- Work performed and samples collected, including associated QA/QC samples, and personnel involved;
- Weather;
- Available analytical results, physical parameter measurements, calculation results, and required QC data;
- Field audits performed and their results;
- Sampling, sample handling, chemical parameter measurement problems, deviations from the approved plan, and corrective actions taken;
- Signatures of field personnel completing the DCQCR, and initials of personnel making changes; and
- Summary of verbal or written instructions for retesting or changes of work.

The DCQCR will be completed at the end of each day. Copies of field forms and pages of the field logbook completed for that day's work will be referenced on the form and attached, to minimize transcription errors.

4.0 SAMPLE PACKAGING AND SHIPPING

This section describes the requirements for proper packaging and shipping of samples for transport from the Site to the laboratory.

4.1 PACKAGING

The procedures and materials used for sample packaging must adequately protect the sample container from accidental breakage during shipping. Sample packaging and labeling will conform to the requirements of Appendix F of Engineering Manual EM-200-1-3 (USACE 2001). Glass sample containers will be placed into plastic bags, and will be wrapped and cushioned in inert packing material such as Styrofoam®, closed-cell foam packing material, or plastic bubble wrap. Plastic sample containers do not require individual cushioning material, but should be packed well to prevent movement during transport. Caps will be screwed on tightly. The plastic sample containers will be placed into individual, resealable plastic bags, which then will be sealed. Ice or an ice-substitute will be placed in the container in a manner that ensures adequate and equal cooling for all samples.

4.2 SHIPPING

All sample containers will be placed inside a strong shipping container such as a metal or plastic cooler with a hard plastic liner. The shipping container will be sufficient to prevent leaks or spills of ice water or potentially broken sample containers. The drainage hole at the bottom of the cooler will be taped shut so that the contents from possible broken containers of sample or packaged ice will not escape. The shipping container lid will be adequately secured with tape to prevent opening during shipping. The shipping container will be adequately cleaned between shipments to prevent cross-contamination of samples.

Transfer of samples from the project Site to the project analytical laboratory is expected to be performed by field personnel or using an overnight courier service. Deliveries that will arrive at a laboratory, or a courier's office to be picked up by laboratory personnel, must be arranged with the laboratory before shipping occurs.

Addresses, telephone numbers, and contacts of the laboratory to which samples will be shipped are presented in Table 4-1 of the RAMP.

5.0 FIELD CORRECTIVE ACTIONS

The ultimate responsibility for maintaining quality throughout the field investigation rests with the PM. The day-to-day responsibility for ensuring the quality of field and laboratory data rests with the Field Superintendent, the Project Chemist, and the laboratory program administrator.

Any nonconformance with the established QC procedures will be expeditiously identified and controlled. Where procedures are not in compliance with the established protocol, corrective actions will be taken immediately. Subsequent work that depends on the nonconforming activity will not be performed until the identified nonconformance is corrected.

The Field Superintendent will review the procedures being implemented in the field for consistency with the established protocols. Sample collection, preservation, labeling, and other sampling procedures will be checked for completeness. Where procedures are not strictly in compliance with the established protocol, deviations will be field-documented and reported to the Project Chemist. Corrective actions will be defined by the Field Superintendent and Project Manager and documented as appropriate. Upon implementation of the corrective action, the Field Superintendent will provide the Project Chemist with a written memorandum documenting field implementation. The memorandum will become part of the field record and permanent project file.

6.0 REFERENCES

American Society for Testing and Materials (ASTM). 2000. *D2488 Standard Practice for Description and Identification of Soil (Visual-Manual Procedure).*

URS. 2002. *Draft Final Site Investigation Report, Former North Pacific Division Laboratory, Troutdale, Oregon.* Prepared for U.S. Army Corps of Engineers, Seattle District, Seattle, Washington. August 30.

United States Army Corps of Engineers (USACE). 2001. *Chemical Data Quality Management for Hazardous, Toxic, Radioactive Waste Remedial Activities.* EM-200-1-3.

ATTACHMENT A
STANDARD FIELD FORMS